Special Flood Hazard Evaluation Report

AD-A203 673

Donner Creek

City of North Tonawanda, Niagara County, New York

JAN 5 1989

Prepared for the City of North Tonawanda, NY

US Army Corps of Engineers
Buffalo District

October 1988

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This report documents the results of an investigation to determine the potential flood situation along Donner Creek (also known as Black Creek). The study was conducted at the request of the City of North Tonawanda under the authority of Section 206 of the 1960 Flood Control Act, as amended. The study reach extends along Donner Creek from —

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immediately upstream of the Conrail Railroad tracks, upstream to the corporate limit, a distance of about 4,700 feet. (R)

SPECIAL FLOOD HAZARD EVALUATION REPORT
DONNER CREEK
CITY OF NORTH TONAWANDA
NIAGARA COUNTY, NEW YORK

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SPECIAL FLOOD HAZARD
EVALUATION REPORT

DONNER CREEK
CITY OF NORTH TONAWANDA
NIAGARA COUNTY, NEW YORK

INTRODUCTION

This Special Flood Hazard Evaluation Report documents the results of an investigation to determine the potential flood situation along Donner Creek (also known as Black Creek). The study was conducted at the request of the city of North Tonawanda under the authority of Section 206 of the 1960 Flood Control Act, as amended. The study reach extends along Donner Creek from immediately upstream of the Conrail railroad tracks, upstream to the corporate limit, a distance of about 4,700 feet.

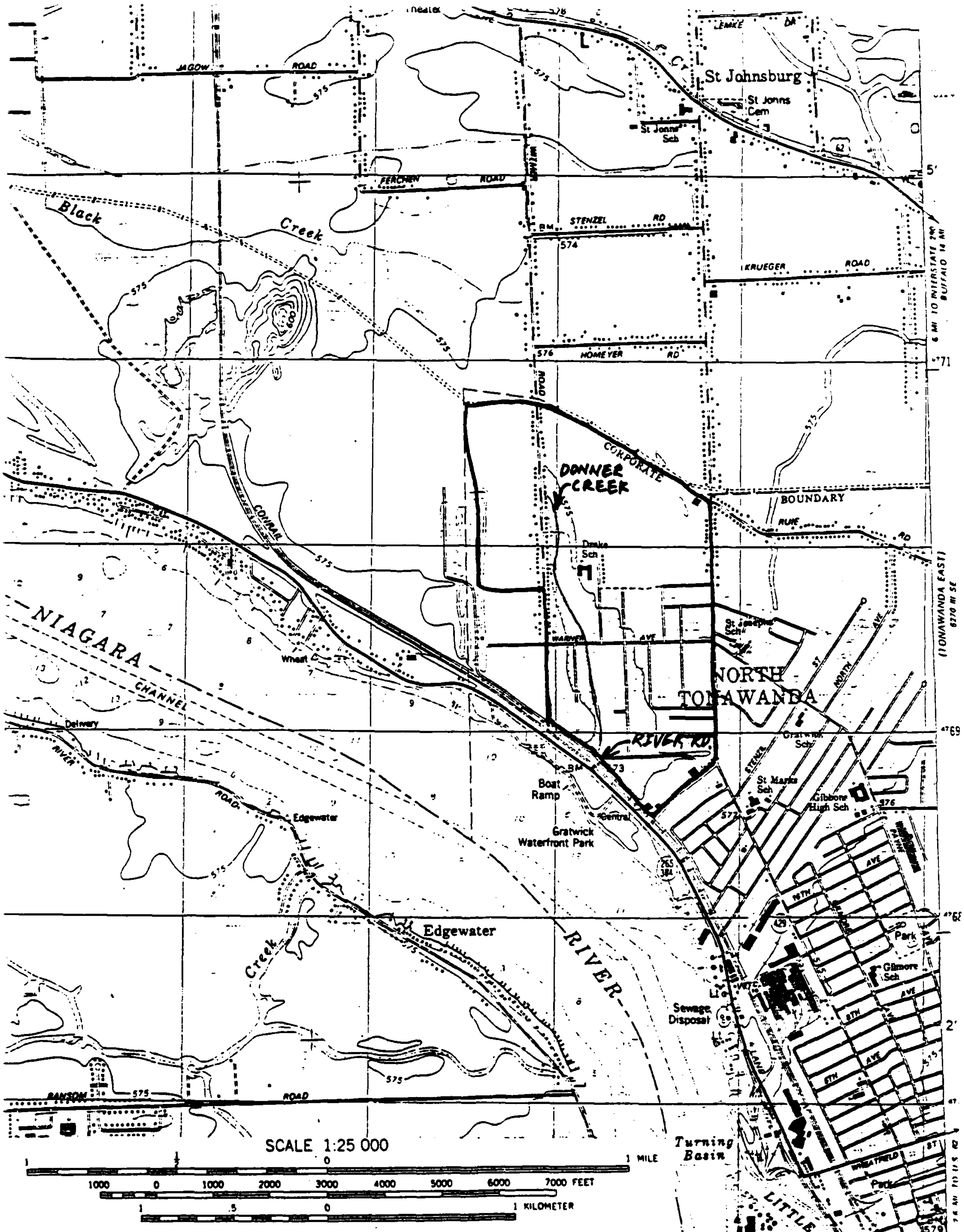
The city of North Tonawanda is located in southwest Niagara County, in western New York. It is bordered by the town of Wheatfield to the north, the town of Amherst to the east, the city of Tonawanda and the town of Tonawanda to the south, and the Niagara River to the west. The climate of the city is moderate. Average snowfall measures 80.0 inches and average precipitation is 32.0 inches per year. The study area is primarily residential with some open land areas.

Donner Creek originates in the northern sector of North Tonawanda and flows south through the Third Ward into the Niagara River. The topography of the basin is flat; total relief within the city is less than 10 feet.

The total drainage area for Donner Creek is 0.74 square miles (See Figure 1). The drainage area was determined by field inspection of the watershed in conjunction with the USGS 7.5 minute topographic map (Reference 1) for the area.

Knowledge of potential floods and flood hazards is important in land use planning. This report identifies the 10- and 100-year flood plain for Donner Creek under existing conditions. The 100-year flood plain is shown on the Flooded Area Maps (Plates 2 and 3). The Water Surface Profile (Plate 1) shows the 10-year and 100-year flood elevations for the study reach.

Additional copies of this report can be obtained from the city of North Tonawanda until its supply is exhausted, and the National Technical Information Service of the U.S. Department of Commerce, Springfield, Virginia 22161, at the cost of reproducing the report. The Buffalo District, Corps of Engineers will provide technical assistance and guidance to planning agencies in the interpretation and use of the data.



St Johnsburg
St Johns Cem
St Johns Sch
JAGOW ROAD
FERCHEN ROAD
STENZEL RD
KRUEGER ROAD
HOMEYER RD
Black Creek
DONNER CREEK
CORPORATE
BOUNDARY
RUIE RD
Drake Sch
WARNER AVE
St Josephs Sch
NORTH TONAWANDA
NIAGARA CHANNEL
RIVER RD
Boat Ramp
Gratwick Waterfront Park
St Marks Sch
Gibbons High Sch
Edgewater
RIVER
Creek
Sewage Disposal
Gilmore Sch
Park
RANSOM ROAD
Turning Basin
LITTLE
SCALE 1:25 000
1 MILE
1000 0 1000 2000 3000 4000 5000 6000 7000 FEET
1 KILOMETER
CONTOUR INTERVAL 5 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

FIGURE 1.

PRINCIPAL FLOOD PROBLEMS

Donner Creek, which receives runoff and storm water from storm sewer outflows, overflows its banks on a regular basis. Flooding to date has been limited to street and yard flooding; however, flood water infiltrates the sanitary sewers through man-hole covers and causes sewer backup and basement flooding. Local residents are concerned about existing flood conditions and the potential for increased flooding as development occurs. In response to these concerns, city officials requested an analysis of the cause of the existing flood problems and what effects future development would have on flooding. They also asked for recommendations which they could implement to alleviate or lessen the flood problem.

Flood Magnitudes and Their Frequencies

Floods are classified on the basis of their frequency or recurrence interval. A 100-year flood is an event with a magnitude that can be expected to be equaled or exceeded once on the average during any 100-year period. It has a 1.0 percent chance of occurring in any given year. It is important to note that, while on a long-term basis the exceedence averages out to once per 100 years, floods of this magnitude can occur in any given year or even in consecutive years and within any given time interval. For example, there is a greater than 50 percent probability that a 100-year event will occur during a 70-year lifetime. Additionally, a house which is built within the 100-year flood level has about a one-in-four chance of being flooded in a 30-year mortgage life.

Hazards and Damages of Large Floods

The extent of damage caused by any flood depends on the topography of the flooded area, the depth and duration of flooding, the velocity of flow, the rate of rise in water surface elevation, and development of the flood plain. Deep water flowing at a high velocity and carrying floating debris would create conditions hazardous to persons and vehicles which attempt to cross the flood plain. Generally, water 3 or more feet deep which flows at a velocity of 3 or more feet per second could easily sweep an adult off his feet and create definite danger of injury or drowning. Rapidly rising and swiftly flowing floodwater may trap persons in homes that are ultimately destroyed or in vehicles that are ultimately submerged or floated. Since water lines can be ruptured by deposits of debris and by the force of flood waters, there is the possibility of contaminated domestic water supplies. Damaged sanitary sewer lines and flooded sewage treatment plants could result in the pollution of floodwaters and could create health hazards. Isolation of areas by floodwater could create hazards in terms of medical, fire, or law enforcement emergencies.

HYDROLOGIC AND HYDRAULIC ANALYSES

Topographic information for the hydrological and hydraulic analyses was obtained from USGS quadrangle and city of North Tonawanda sewer maps and was supplemented by field surveys. Stream cross sectional data and spot elevations in the overbank were obtained. All culverts were surveyed to obtain elevation data and structural geometry. Locations of selected cross sections used in the analyses are shown on the Flood Profile and the Flooded Area Map, where applicable.

The basin was divided into three areas where storage occurs: upstream of Witmer Road; upstream of Warner Avenue to Witmer Road; and upstream of River Road to Warner Avenue. An undersize culvert at each of these locations causes water to back-up during a rainfall event.

Because of the small size of the drainage basin and the significant storage that occurs, the Soil Conservation Service Method TR-20 was used to compute the peak discharges through the culverts and the resulting upstream pool elevations (Reference 2). This method is capable of developing runoff hydrographs, routing hydrographs through channel reaches, and combining or separating hydrographs at confluences. It has the additional ability to storage-route hydrographs through structures. Channel elevations, discharge and storage characteristics, drainage area, land use curve number, time of concentration, and culvert rating curves for each of the sub-basins were input to the TR-20 program. Rating curves which define flow through the culverts were developed using standard pipe flow equations.

Table 1 presents the results of the analysis for Donner Creek. The peak discharges presented are those experienced by the 30-inch culvert beneath both Warner Avenue and River Road. The peak elevations are those immediately upstream of the culverts.

Table 1 - 10-Year and 100-Year Peak Discharges and Water Surface Elevations for Donner Creek

Location	Drainage Area	10-Year		100-Year	
		Peak Discharge	Peak W.S. Elevation	Peak Discharge	Peak W.S. Elevation
	(mi^2)	(cfs)	(ft-NGVD)	(cfs)	(ft-NGVD)
Warner Avenue	0.52	10	573.0	12	574.1
River Road	0.74	14	572.0	16	572.6

Water surface elevations for the 10- and 100-year recurrence interval floods were computed using the COE HEC-2 step-backwater computer program (Reference 3). The starting water surface elevation for each analysis was the peak water surface elevation immediately upstream of the River Road culvert, as determined by the TR-20 model.

Channel and overbank roughness factors (Manning's "n") used in the hydraulic computations were chosen by engineering judgement and were based on field observations of the stream and the floodplain areas. Manning's roughness coefficients used in the analysis ranged from 0.02-0.05 for the channel and 0.06 to 0.08 for the overbank areas. Contraction and expansion coefficients ranged from 0.1 to 0.3 for contraction and 0.3 to 0.5 for expansion of flows.

The computed 10-year and 100-year water surface profiles for Donner Creek are shown on Plate 1. The 100-year flood plain boundaries are shown on Plates 2 and 3. These boundaries were delineated using the flood elevations determined at each cross section. Between cross sections, the boundaries were interpolated using the USGS topographic maps for the area and spot elevations obtained during the field survey. Small areas within the flood plain boundaries may be above the flood elevations but cannot be shown due to limitations of the map scale and/or lack of detailed topography.

The hydraulic analyses for this study were based on unobstructed flow. The flood elevations shown on the profile are thus considered valid only if hydraulic structures remain unobstructed, operate properly, and do not fail.

All elevations are referenced to the National Geodetic Vertical Datum of 1929 (NGVD). Elevation reference marks used in this study are shown on Plates 2 and 3; the descriptions of the marks are presented in Table 2.

Flood profiles under future developed conditions were not modeled. Because of the heavy soil types within the basin, infiltration of rainwater is not high; therefore, the proposed urbanization north of Hawley Drive between Drake Road and Homestead Road, would not significantly increase runoff.

As shown on the drainage area map (Figure 1), the watershed for Donner Creek does not include any area north of the city of North Tonawanda corporate limit. Development in the town of Wheatfield would therefore have little impact on Donner Creek unless drainage patterns were altered.

Table 2 - Elevation Reference Marks

Reference Mark	Elevation (feet NGVD)	Description of Location (1)
RM-1	572.93	USGS Monument (Bronze Disc) H-20, set in downstream east side of concrete headwall of railroad bridge near River Road over Donner Creek.
RM-2	574.86	PK set in intersection of Warner Avenue and Doyle Drive.
RM-3	577.51	Northeast Bonnett Bolt on hydrant, 95' south of Hawley Drive and Witmer Road intersection, on west side of Witmer Road.

(1) Approximate locations of Reference Marks are shown on the Flooded Area Maps (Plates 2 and 3).

UNIFIED FLOOD PLAIN MANAGEMENT

Historically, the alleviation of flood damage has been accomplished almost exclusively by the construction of protective works such as reservoirs, channel improvements, and floodwalls and levees. However, in spite of the billions of dollars that have already been spent for construction of well-designed and efficient flood control works, annual flood damages continue to increase because the number of persons and structures occupying floodprone lands is increasing faster than protective works can be provided.

Recognition of this trend has forced a reassessment of the flood control concept and resulted in the broadened concept of unified flood plain management programs. Legislative and administrative policies frequently cite two approaches: structural and nonstructural, for adjusting to the flood hazard. In this context, "structural" is usually intended to mean adjustments that modify the behavior of floodwaters through the use of measures such as dams and channel work. "Nonstructural" is usually intended to include all other adjustments in the way society acts when occupying or modifying a flood plain (e.g., regulations, floodproofing, insurance, etc.). Both structural and nonstructural tools are used for achieving desired future flood plain conditions. There are three basic strategies which may be applied individually or in combination: (1) modifying the susceptibility to flood damage and disruption, (2) modifying the floods themselves, and (3) modifying (reducing) the adverse impacts of floods on the individual and the community.

Modify Susceptibility to Flood Damage and Disruption

The strategy to modify susceptibility to flood damage and disruption consists of actions to avoid dangerous, economically undesirable, or unwise use of the flood plain. Responsibility for implementing such actions rests largely with the non-Federal sector and primarily at the local level of Government.

These actions include restrictions in the mode and the time of occupancy; in the ways and means of access; in the pattern, density, and elevation of structures and in the character of their materials (structural strength, absorptiveness, solubility, corrodibility); in the shape and type of buildings and in their contents; and in the appurtenant facilities and landscaping of the grounds. The strategy may also necessitate changes in the interdependencies between flood plains and surrounding areas not subject to flooding, especially interdependencies regarding utilities and commerce. Implementing mechanisms for these actions include land use regulations, development and redevelopment policies, floodproofing, disaster preparedness and response plans, and flood forecasting and warning systems. Different tools may be more suitable for developed or underdeveloped flood plains or to urban or rural areas. The information contained in this report is particularly useful for the preparation of flood plain regulations.

a. Flood Plain Regulations.

Flood plain regulations apply to the full range of ordinances and other means designed to control land use and construction within floodprone areas. The term encompasses zoning ordinances, subdivision regulations, building and

housing codes, encroachment line statutes, open area regulations, and other similar methods of management which affect the use and development of floodprone areas.

Flood plain land use management does not prohibit use of floodprone areas; to the contrary, flood plain land use management seeks the best use of flood plain lands. The flooded area maps and the water surface profile contained in this report can be used to guide development in the flood plain. The elevations shown on the profile should be used to determine flood heights because they are more accurate than the outlines of flooded areas. It is recommended that development in areas susceptable to frequent flooding adhere to the principles expressed in Executive Order 11988 - Floodplain Management, whose objective is to "...avoid to the extent possible the long and short-term adverse impacts associated with the occupancy and modification of flood plains ... wherever there is a practicable alternative." Accordingly, development in areas susceptible to frequent flooding should consist of construction which has a low damage potential such as parking areas and golf courses. High value construction such as buildings should be located outside the flood plain to the fullest extent possible. In instances where no practicable alternative exists, the land should be elevated to minimize damages. If it is uneconomical to elevate the land in these areas, means of floodproofing the structures should be given careful consideration.

b. Formulation of Flood Plain Regulations

Formulation of flood plain regulations in a simplified sense involves selecting the type and degree of control to be exercised for each specific flood plain. In principle, the form of the regulations is not as important as a maintained adequacy of control. The degree of control normally varies with the flood hazard as measured by depth of inundation, velocity of flow, frequency of flooding, and the need for available land. Considerable planning and research is required for the proper formulation of flood plain regulations. Where formulation of flood plain regulations is envisioned to require a lengthy period of time during which development is likely to occur, temporary regulations should be adopted to be amended later as necessary.

Modify Flooding

The traditional strategy of modifying floods through the construction of dams, dikes, levees and floodwalls, channel alterations, high flow diversions and spillways, and land treatment measures has repeatedly demonstrated its effectiveness for protecting property and saving lives, and it will continue to be a strategy of flood plain management. However, in the future, reliance solely upon a flood modification strategy is neither possible nor desirable. Although the large capital investment required by flood modifying tools has been provided largely by the Federal Government, sufficient funds from Federal sources have not been and are not likely to be available to meet all situations for which flood modifying measures would be both effective and economically feasible. Another consideration is that the cost of maintaining and operating flood control structures falls upon local governments.

Flood modifications acting alone leave a residual flood loss potential and can encourage an unwarranted sense of security leading to inappropriate use of lands in the areas that are directly protected or in adjacent areas. For this reason, measures to modify possible floods should usually be accompanied by measures to modify the susceptibility to flood damage, particularly by land use regulations.

Modify the Impact of Flooding on Individuals and the Community

A third strategy for mitigating flood losses consists of actions designed to assist individuals and communities in their preparatory, survival, and recovery responses to floods. Tools include information dissemination and education, arrangements for spreading the costs of the loss over time, purposeful transfer of some of the individual's loss to the community by reducing taxes in floodprone areas, and the purchase of Federally subsidized flood insurance.

The distinction between a reasonable and unreasonable transfer of costs from the individual to the community can also be regulated and is a key to effective flood plain management.

CONCEPTUAL FLOOD CONTROL ALTERNATIVES

As previously stated, in addition to identifying the existing flood problems, the city of North Tonawanda also requested that conceptual alternatives be developed to alleviate or lessen the flood threat. Implementation of these alternatives, including their design and funding, would be the responsibility of the local home owner and/or city.

The primary cause of flooding along Donner Creek is the undersized culverts at River Road, Warner Avenue, and Witmer Road, which cause water to back-up during a rainfall event. To date, flooding has been limited to street and yard flooding; however, water infiltrates the sanitary sewers through man-hole covers and causes sewer back-up and basement flooding.

Both structural and nonstructural alternatives are available to alleviate or lessen the flood threat. Nonstructural alternatives include implementing flood plain regulations that would limit or prohibit future growth in the flood plain. Thus, flood damages would not increase. Further, individual homeowners could install check valves in their sanitary sewer lines. A check valve permits normal flow from the house to the main sewer line, but during flooding, prevents sewer water from flowing back into the house by means of a check or restrictive mechanism in the valve.

Structural solutions can also be implemented to alleviate or lessen the flood threat. It is up to the city and local residents to determine whether or not it is justifiable to implement these alternatives.

The culverts under River Road, Warner Avenue, and Witmer Road can be enlarged to adequately pass the flood flow. However, due to the suspected presence of

toxic material in the ground, it may not be possible to replace the River Road culvert. In that case, either a pumping system or an extension to the City's storm sewer system would have to be installed in the vicinity of Donner Pond. If this was not done, the increased flow from the upper portion of the watershed due to replacing the two upstream culverts would significantly increase flooding in the Donner Pond area. The pumping system would consist of a pump at Donner Pond and either a temporary discharge pipe installed across River Road during each flood event or a permanent discharge pipe installed inside the existing culvert. The storm sewer extension would run from Donner Pond northwesterly along the city owned railroad right-of-way and would discharge into the City's proposed northwest storm sewer system.

CONCLUSION

This report presents local flood hazard information for Donner Creek in the city of North Tonawanda, New York. The U.S. Army Corps of Engineers, Buffalo District, will provide interpretation in the application of the data contained in this report, particularly as to its use in developing effective flood plain regulations. Requests should be coordinated with the New York State Department of Environmental Conservation. In addition, it is also recommended that the city request that the Federal Emergency Management Agency amend the Flood Insurance Rate map for the city to include the results of this study.

GLOSSARY

BACKWATER	The resulting high water surface in a given stream due to a downstream obstruction or high stages in an intersecting stream.
BASE FLOOD	A flood which has an average return interval in the order of once in 100 years, although the flood may occur in any year. It is based on statistical analysis of streamflow records available for the watershed and analysis of rainfall and runoff characteristics in the general region of the watershed. It is commonly referred to as the "100-year flood."
DISCHARGE	The quantity of flow in a stream at any given time, usually measured in cubic feet per second (cfs).
FLOOD	An overflow of lands not normally covered by water. Floods have two essential characteristics: The inundation of land is temporary and the lands are adjacent to and inundated by overflow from a river, stream, ocean, lake, or other body of standing water. Normally a "flood" is considered as any temporary rise in streamflow or stage, but not the ponding of surface water, that results in significant adverse effects in the vicinity. Adverse effects may include damages from overflow of land areas, temporary backwater effects in sewers and local drainage channels, creation of unsanitary conditions or other unfavorable situations by deposition of materials in stream channels during flood recessions, and rise of groundwater coincident with increased streamflow.
FLOOD CREST	The maximum stage or elevation reached by floodwaters at a given location.
FLOOD FREQUENCY	A statistical expression of the percent chance of exceeding a discharge of a given magnitude in any given year. For example, a 100-year flood has a magnitude expected to be exceeded on the average of once every hundred years. Such a flood has a 1 percent chance of being exceeded in any given year. Often used interchangeably with RECURRENCE INTERVAL.
FLOOD PLAIN	The areas adjoining a river, stream, watercourse, ocean, lake, or other body of standing water that have been or may be covered by floodwater.

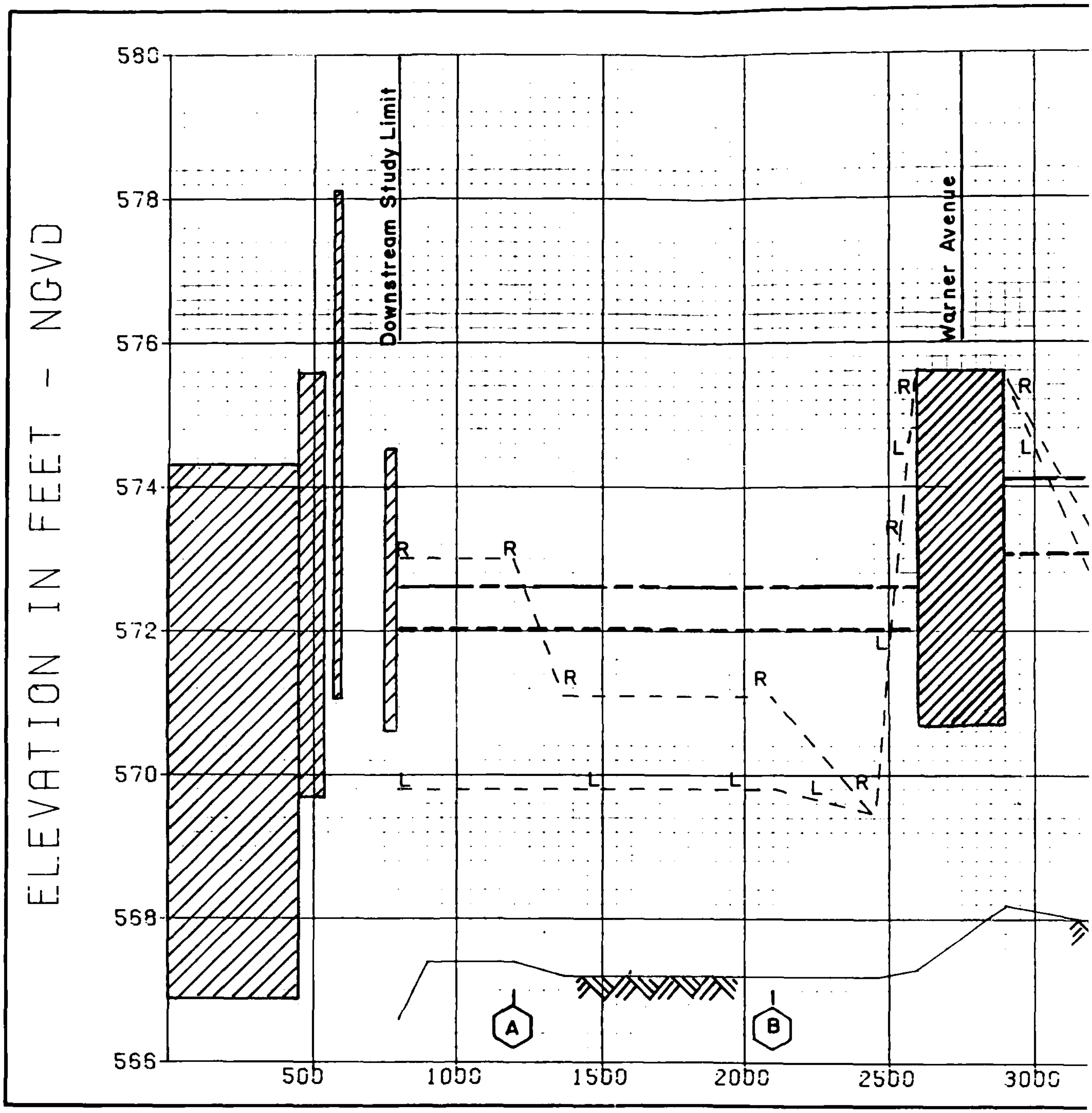
FLOOD PROFILE	A graph showing the relationship of water surface elevation to location; the latter generally expressed as distance upstream from a known point along the approximate centerline of a stream of water that flows in an open channel. It is generally drawn to show surface elevation for the crest of a specific flood, but may be prepared for conditions at a given time or stage.
FLOOD STAGE	The stage or elevation at which overflow of the natural banks of a stream or body of water begins in the reach or area in which the elevation is measured.
FLOODWAY	The channel of a watercourse and those portions of the adjoining flood plain required to provide for the passage of the selected flood (normally the 100-year flood) with an insignificant increase in the flood levels above that of natural conditions. As used in the National Flood Insurance Program, floodways must be large enough to pass the 100-year flood without causing an increase in elevation of more than a specified amount (1 foot in most areas).
RECURRENCE INTERVAL	A statistical expression of the average time between floods exceeding a given magnitude (see FLOOD FREQUENCY).

REFERENCES

1. U.S. Department of the Interior, Geological Survey, 7.5 Minute series (topographic) Map, Scale 1:25000, Contour Interval 5 feet, Tonawanda West, New York, dated 1980.

2. U.S. Soil Conservation Service, Technical Release 20 Computer Program for Project Formulation, Hydrology (TR-20).

3. U.S. Army Corps of Engineers, Hydrologic Engineering Center, HEC-2 Water Surface Profiles Generalized Computer Program, Davis, California 1974.



NOTE: Distance
from the
River.

LEGEND

10-YEAR FLOOD

100-YEAR FLOOD

CHANNEL BOTTOM

CROSS SECTION LOCATION

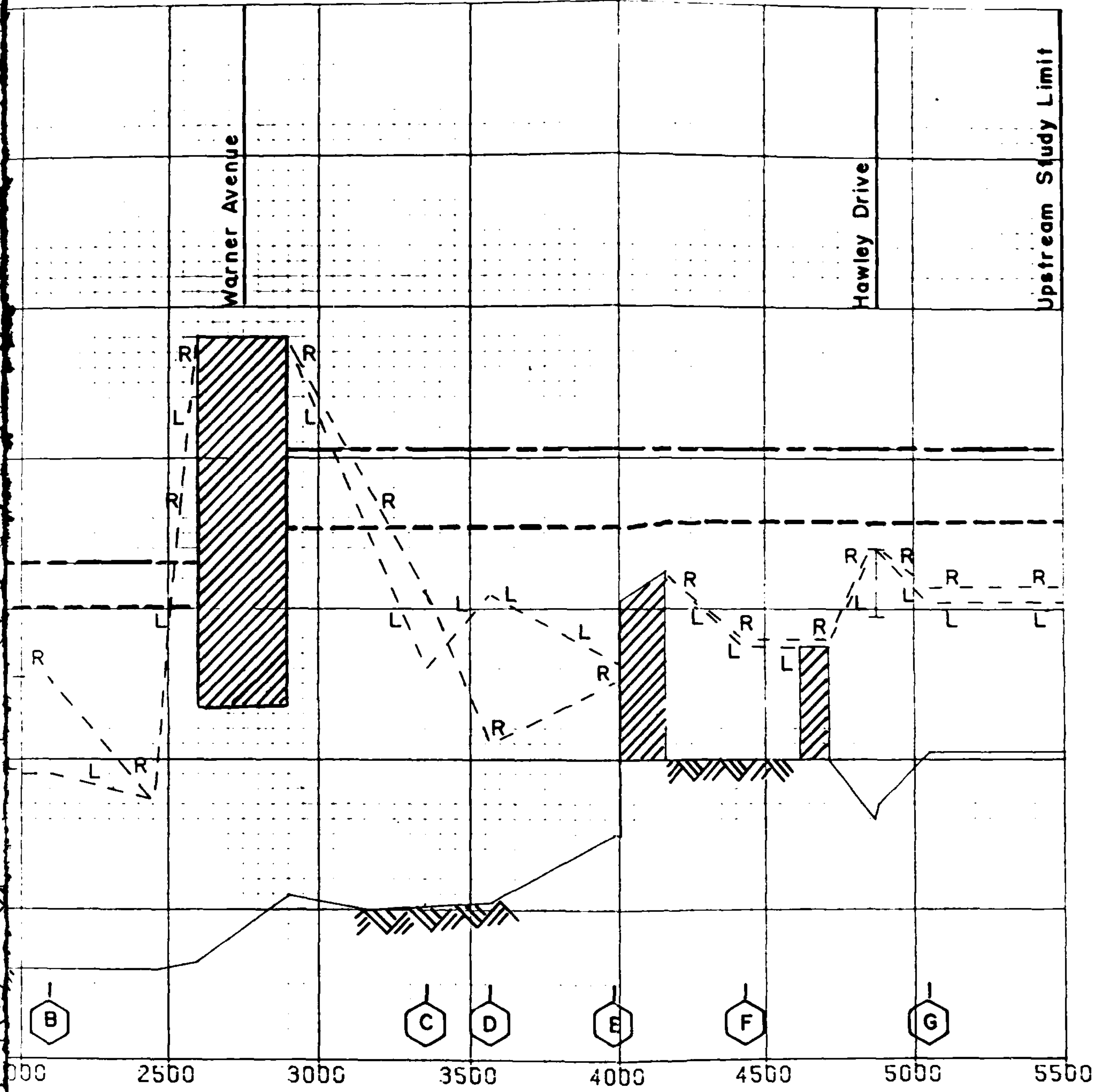
CULVERT

BRIDGE

RIGHT BA

LEFT BA

1



NOTE: Distance is measured in feet from the mouth at the Niagara River.

TION LOCATION

R---- RIGHT BANK

L---- LEFT BANK

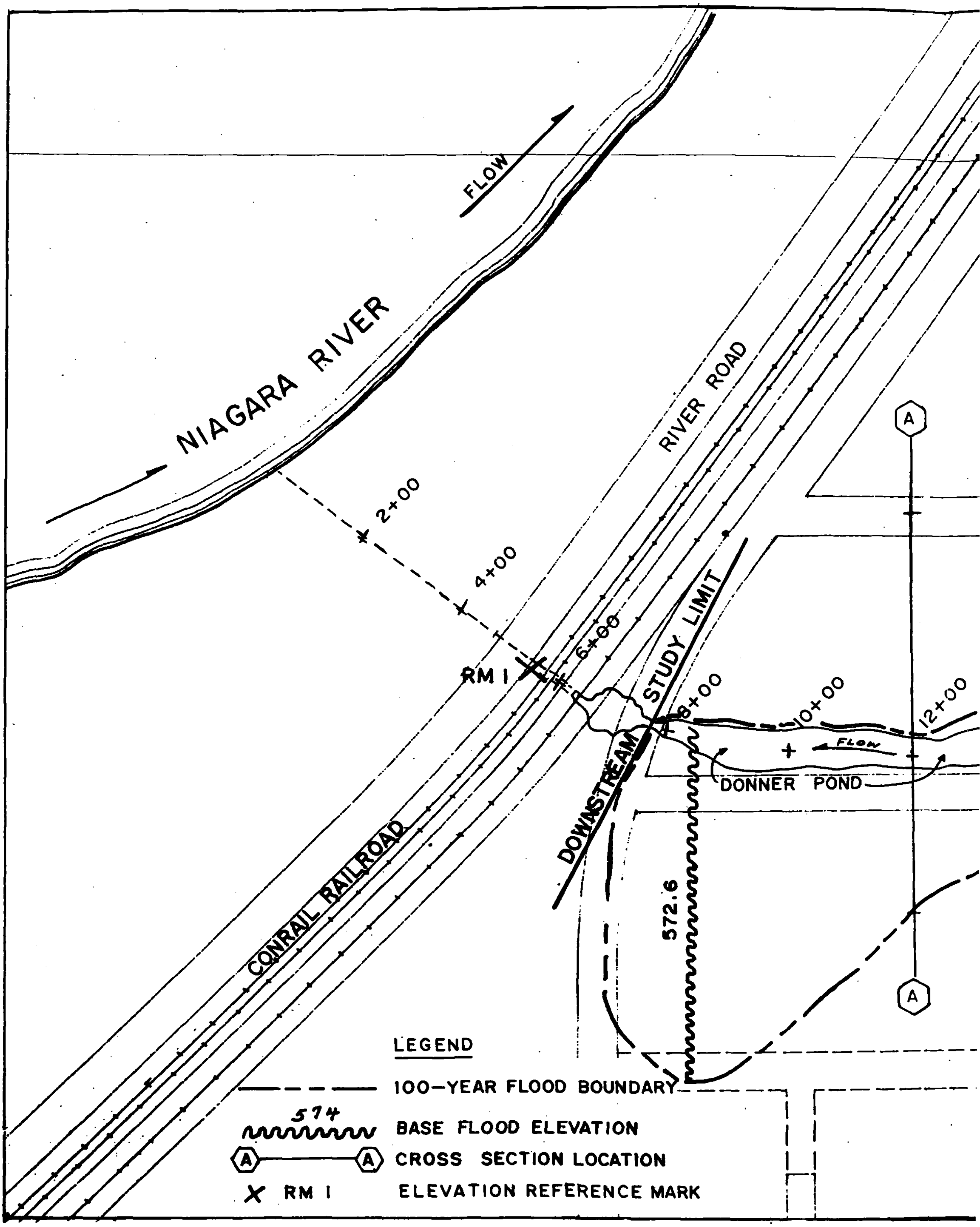
U. S. Army Engineer District, Buffalo
SPECIAL FLOOD HAZARD EVALUATION

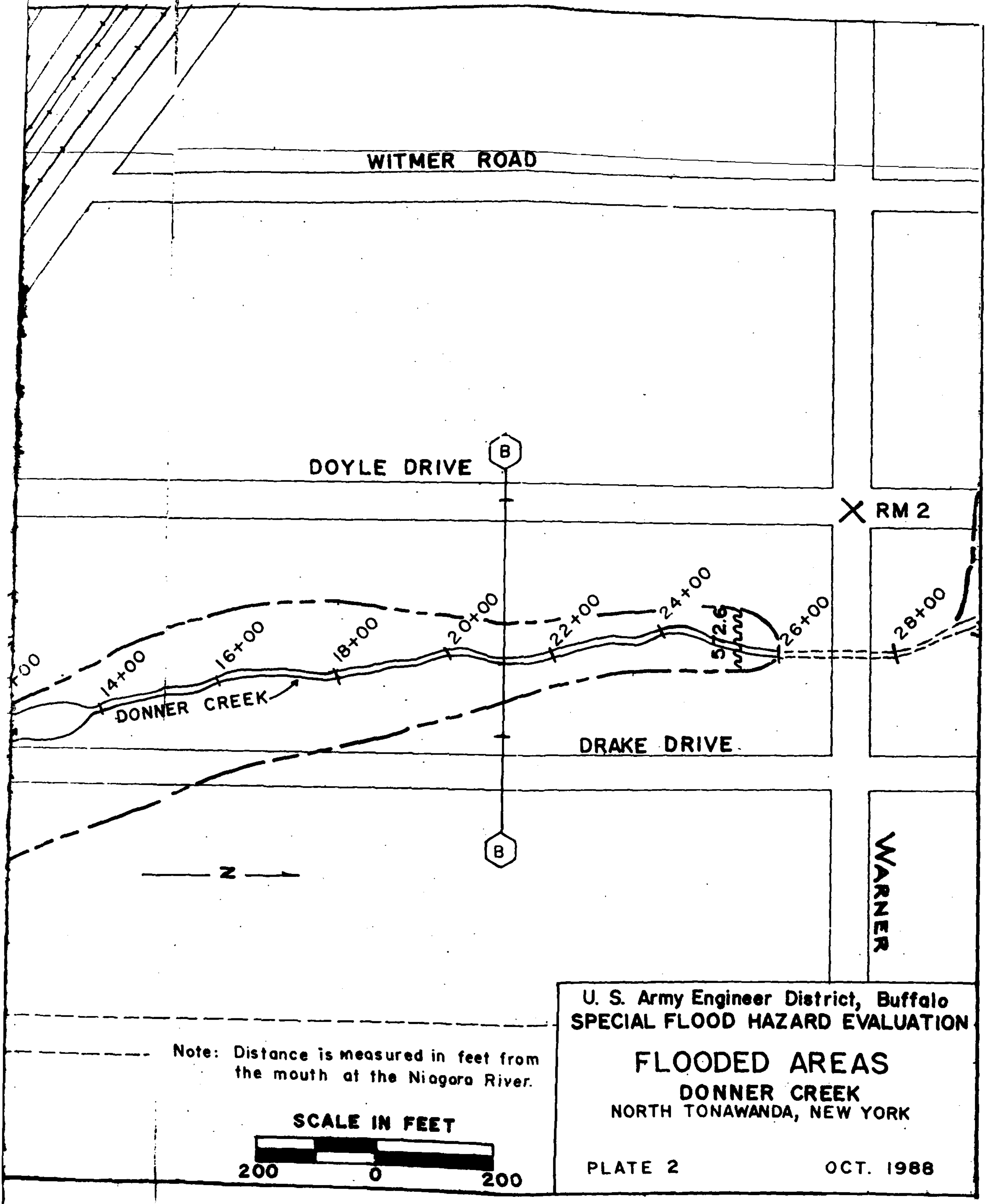
FLOOD PROFILE

DONNER CREEK

NORTH TONAWANDA, NEW YORK

PLATE I OCT. 1988


NIAGARA RIVER
FLOW
RIVER ROAD
2+00
4+00
6+00
8+00
10+00
12+00
RM 1
STUDY LIMIT
DOWNSTREAM
CONRAIL RAILROAD
FLOW
DONNER POND
572.6
A
A
LEGEND
100-YEAR FLOOD BOUNDARY
574
BASE FLOOD ELEVATION
A
A
CROSS SECTION LOCATION
RM 1
ELEVATION REFERENCE MARK



Note: Distance is measured in feet from the mouth at the Niagara River.

U. S. Army Engineer District, Buffalo
SPECIAL FLOOD HAZARD EVALUATION

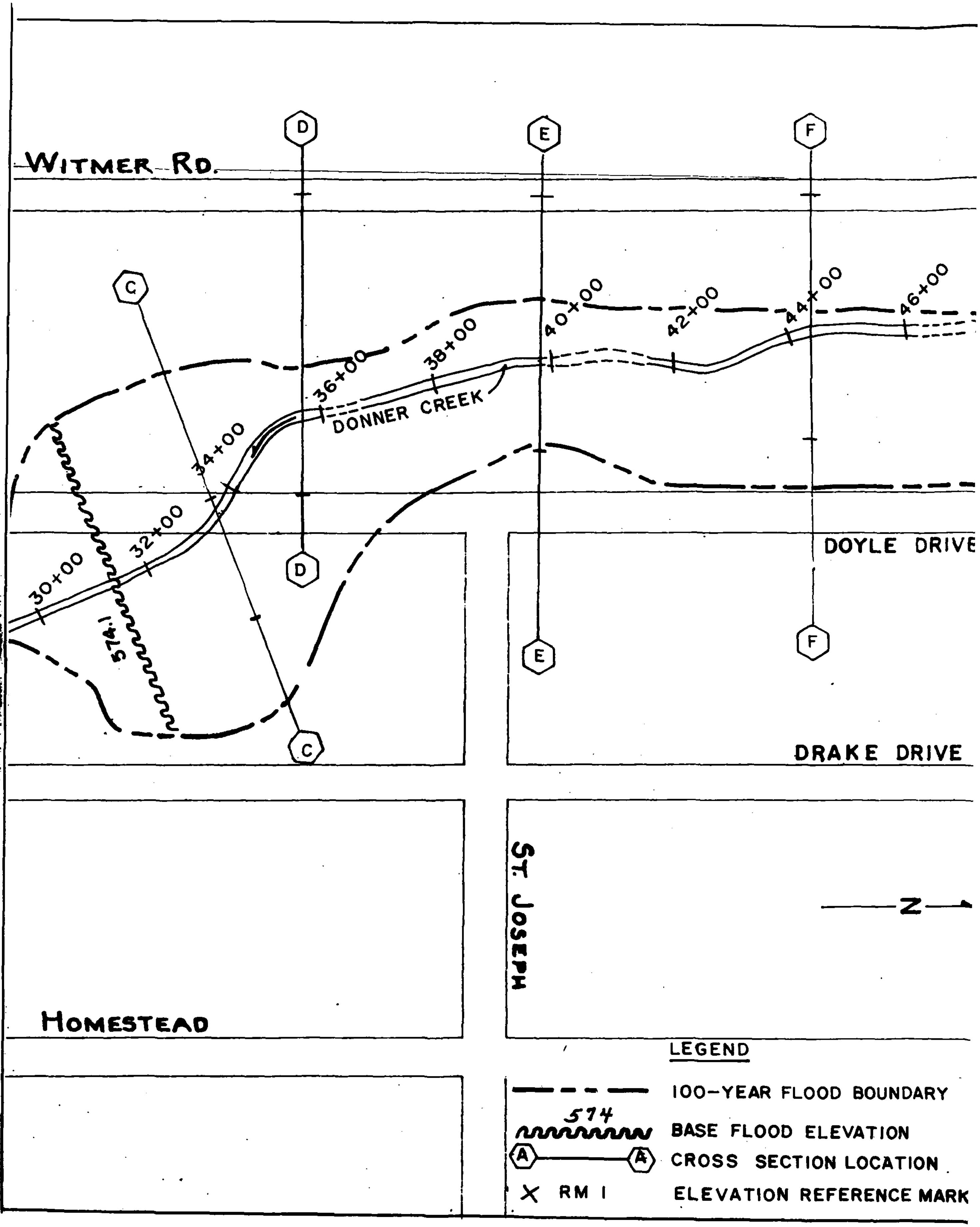
FLOODED AREAS

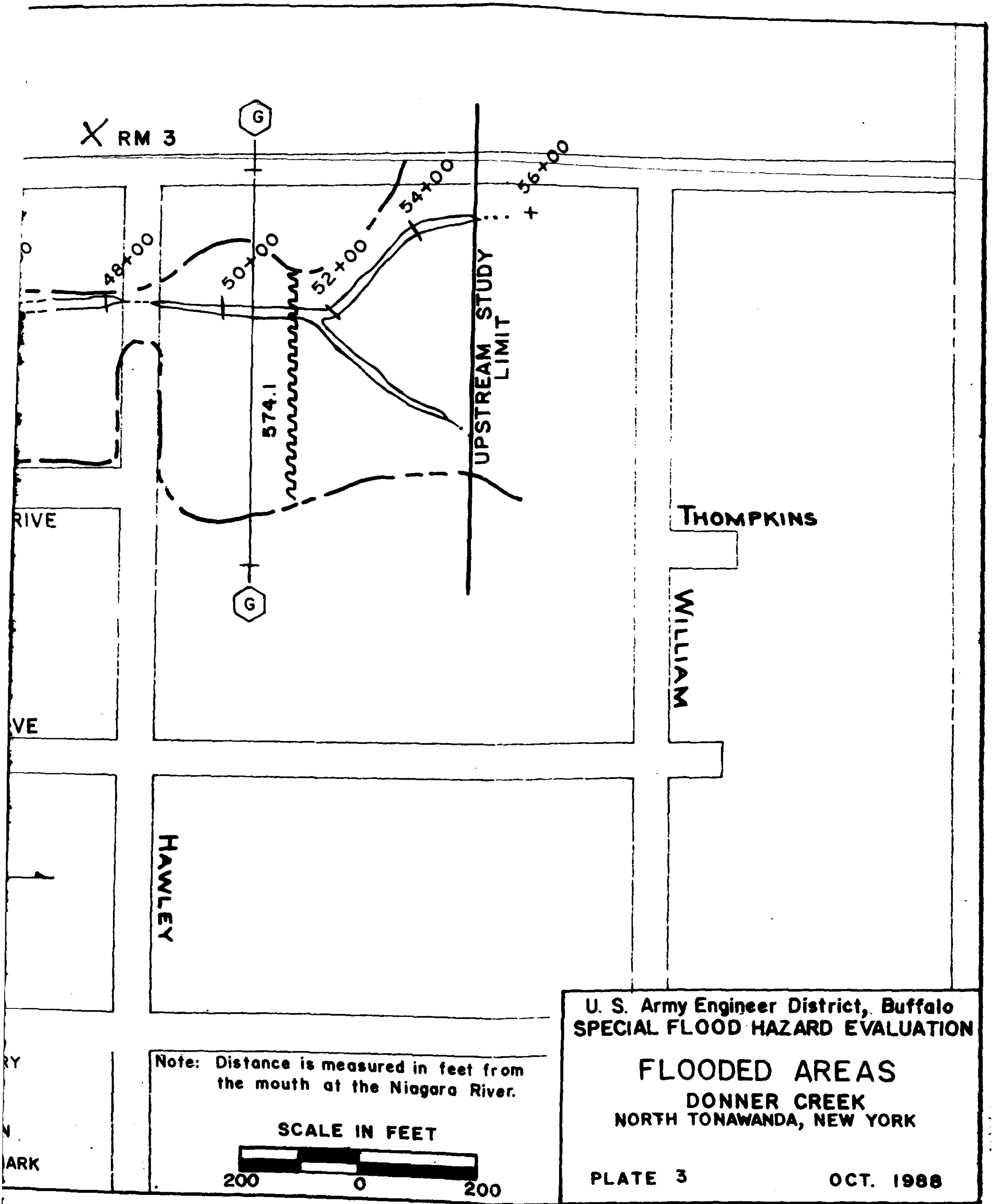
DONNER CREEK
NORTH TONAWANDA, NEW YORK

PLATE 2 OCT. 1988

1

2


WITMER RD.
DONNER CREEK
DOYLE DRIVE
DRAKE DRIVE
ST. JOSEPH
HOMESTEAD
30+00
32+00
34+00
36+00
38+00
40+00
42+00
44+00
46+00
574.1
N
LEGEND
100-YEAR FLOOD BOUNDARY
574
BASE FLOOD ELEVATION
CROSS SECTION LOCATION
RM 1
ELEVATION REFERENCE MARK



U. S. Army Engineer District, Buffalo
SPECIAL FLOOD HAZARD EVALUATION

FLOODED AREAS

DONNER CREEK
NORTH TONAWANDA, NEW YORK

PLATE 3 OCT. 1988

2